Are children playgrounds safe play areas? Inorganic analysis and lead isotope ratios for contamination assessment in recreational

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Abstract

In city playgrounds, there is a potential risk of harming children's health by contamination coming from anthropogenic activities. With the aim to determinate the sources and the risk of hazardous elements, soil samples were collected in 19 selected playgrounds of different urban and rural areas from the Rio Grande do Sul state (Brazil). The concentration of 23 metals and metalloids and lead isotopic ratios were determined by ICP-MS. The methodology proposed here, firstly, classified the parks according to the average metal content by means of the NWACs (Normalized-and-Weighted Average Concentrations) and assess the contamination risk determining the Contamination Factors (CFs). Finally, statistical tools (correlation analysis and principal component analysis) were used to identify the most important contamination sources. The statistical tools used, together with lead isotopic composition analysis of the samples, revealed that coal combustion is the main source of contamination in the area. Vegetation was identified as a barrier for the contamination coming from the city. Nonetheless, some of the soils present a possible toxicological risk for humans. In fact, Cr, Sb, and Pb concentrations were higher than the Residential Intervention Values (VIRs) defined by the Environmental Protection Agency of the State of São Paulo, also in Brazil.

Keywords

Metals, Playgrounds, Normalized-And-Weighted Average Concentration, Chemometric Analysis, Human Health, ICP-MS, Lead Isotopic Ratio